

REMARKS

Claims 1, 2, 8-16, 20, 21 and 24-26 and 28-40 are active. Independent Claim 1 has been limited to 5-aminotetrazole, guanidine nitrate and strontium nitrate. These compounds are described in the original dependent claims and specifically at page 12, lines 1-3, page 12, lines 6-9 and on page 14, lines 18-20, of the specification. A guanidine nitrate particle size of 40 μm or less is described on page 13, lines 10-12 of the specification. Editorial changes to improve the clarity of the claims have been made to Claims 2, 9, 10, 11, 13-16, 20, 21 and 24-26. Support for new Claims 28-40 is found in the disclosure, specifically as follows: Claims 28 and 29 at page 16, lines 19-20; Claim 30 at page 12, line 19; Claim 31 at page 13, line 2; Claim 32 at page 12, line 22; Claims 33-34 at page 23, lines 18-19; Claim 35 in original Claim 1; Claims 36 and 37 at page 34; Claim 38 in original Claim 1; Claim 39 in original Claims 1, 4 and 15, and Claim 40 at page 24, line 12. Accordingly, the Applicants do not believe that any new matter has been added.

The Applicants thank Examiner Miller for the courteous and helpful interview of March 26, 2003. Limitation of the claims to 5-aminotetrazole, guanidine nitrate and strontium nitrate was discussed. It was suggested that the Applicants specifically address Lundstrom, U.S. Patent No. 5,756,929, Table 1, Examples 2-5, and elaborate on the experimental data of record showing the importance of selecting a 50% average particle size of 40 μm or less for guanidine nitrate.

Rejection—35 U.S.C. 103

Claims 1-27 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kanda et al., U.S. Patent 6,177,128, in view of Lunstrom et al., U.S. Patent No. 5,756,929, Cabrera, U.S. Patent No. 5,844,164, Ito et al., U.S. Patent 6,033,500, Lunstrom et al., U.S. Patent No.

6,093,269 and Yoshikawa et al., U.S. Patent No. 6,416,599. The cited prior art does not disclose or suggest the present invention in view of the amendment of independent Claim 1.

Kanda et al., Cabrera, Ito et al., Lundstrom et al., U.S. Patent No. 6,093,269 ('269) and Yoshikawa et al. do not disclose or suggest the combination of 5-aminotetrazole, guanidine nitrate with a 50% average particle size of 40 μ or less, and strontium nitrate as now required by independent Claim 17. For instance, Kanda, col. 6, lines 1-20, does not teach the secondary fuel guanidine nitrate; Cabrera, col. 4, lines 1-14, and Ito, col. 8, lines 43-49, do not disclose guanidine nitrate or selection of a guanidine nitrate 50% average particle size of 40 μ or less; Lundstrom, '269, is generally directed to gas generants comprising aminoguanidine and nitric acid, see col. 2, lines 60-65 and claim 1; Yoshikawa is directed to gas generants comprising 5-aminotetrazole and strontium nitrate, see col. 4, line 36-line 67, but does not suggest the combination of 5-aminotetrazole, guanidine nitrate with a 50% average particle size of 40 μ or less, and strontium nitrate.

Lundstrom et al., U.S. Patent 5,756,929, was reviewed during the interview and the examiner pointed out that Table 1, Examples 2-5, describes gas generants comprising 5-aminotetrazole, strontium nitrate and guanidine nitrate. However, there is no suggestion to select a 50% average particle size for guanidine nitrate of 40 μ m or less. As shown in the experimental data in the disclosure, use of a 50% average particle size above 40 μ m does not provide the same desirable gas generant characteristics of the present invention. The combustion speed of the gas generants of the present invention is slower than prior art gas generants particularly in the period of 20 ms from the time of ignition, see the specification, page 13, lines 12-15. However, when the 50% average particle diameter of the low-energy nitrogen-containing organic compound (guanidine nitrate) is about 40 μ m, a slower combustion speed in the period of 10-20ms from ignition is not achieved as exemplified in the specification. Example 1 (pages 25-26 of the specification) and Comparative Example 1

(pages 31-32 of the specification), respectively, compare the effects of selecting a 50% average particle size for guanidine nitrate of below and above 40 μm in the 60 liter tank pressure test. As shown in the table below, selection of a 50% average particle size of below 40 μm in Example 1 modulated the rate of pressure increase in the first 10-20 milliseconds compared to the more rapid rate of pressure increase produced by a reaction involving guanidine nitrate with a 50% average particle size above 40 μm in Comparative Example 3.

60 liter tank test pressure (kPa)						
	10ms	20ms	30ms	40ms	50ms	
Example 1	18.0	62.0	136.0	158.0	178.0	5-AT (24.7 parts, 15 μm), guanidine nitrate (11.9 parts, 30 μm) Sr nitrate (53.4 parts, 13 μm) SnN (5 parts); hydrotalcite (5 parts)
Comparative Example 3	24.0	97.0	138.0	163.0	178.0	5-AT (24.7 parts, 15 μm), guanidine nitrate (11.9 parts, 50 μm) Sr nitrate (53.4 parts, 13 μm) SnN (5 parts), Hydrotalcite (5 parts)

One with skill in the art would recognize the advantages of the slower rate of pressure increase provided by the invention. For instance, page 3, lines 21-23, of the specification describes the potential harm from rapid air-bag inflation. A slower gas generation speed in the period between 10 and 20 milliseconds from ignition provides for a more ideal occupant protecting performance, as described in the specification at page 4, lines 1-6. Accordingly, the Applicants submit that this rejection may now be withdrawn.

CONCLUSION

In view of the above amendments and remarks, the Applicants respectfully submit that this application is now in condition for allowance. Early notification to that effect is earnestly solicited.

Respectfully submitted,

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IN THE CLAIMS

1. (Amended) A composition comprising:

5-aminotetrazole and

guanidine nitrate which has a 50% average particle size of 40 μm or less; and

strontium nitrate and

an additive

[a fuel, an oxidizing agent, and an additive,

wherein the fuel comprises at least one high-energy nitrogen-containing organic compound and at least one low-energy nitrogen-containing organic compound;

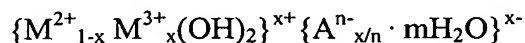
the low-energy nitrogen-containing organic compound has a 50% average particle diameter of 40 μm or less; and the high energy nitrogen-containing organic compound is 5-aminotetrazole, the low-energy nitrogen-containing compound is guanidine nitrate, and the oxidizing agent is strontium nitrate].

2. (Amended) The composition of Claim 1, wherein the [low-energy nitrogen-containing organic compound] guanidine nitrate has [the] an 50% average particle diameter of 20 μm or less.

Claims 3-7. (Cancelled)

8. (Unamended) The composition of Claim 1, wherein the additive comprises silicon nitride or silicon carbide.

9. (Amended) The composition of Claim 1, wherein the additive comprises one or more hydrotalcites expressed by the following general formula:



where M^{2+} represents bivalent metals including Mg^{2+} , Mn^{2+} , Fe^{2+} , Co^{2+} , Ni^{2+} , Cu^{2+} and Zn^{2+} ;

M^{3+} represents trivalent metals including Al^{3+} , Fe^{3+} , Cr^{3+} , Co^{3+} and In^{3+} ;

A^{n-} represents n-valence anions including OH^- , F^- , Cl^- , NO_3^- , CO_3^{2-} , SO_4^{2-} , $Fe(CN)_6^{3-}$, CH_3COO^- , ion oxalate, and ion salicylate; and

$X = 0 < x < 0.33$.

10. (Amended) The composition of Claim 1 [9, wherein the hydrotalcites comprise] comprising a synthetic hydrotalcite expressed by the chemical formula of $Mg_6Al_2(OH)_{16}CO_3 \cdot 4H_2O$ or a pyroaurite expressed by the chemical formula of $Mg_6Fe_2(OH)_{16}CO_3 \cdot 4H_2O$.

11. (Amended) The composition of Claim 1, wherein the additive comprises at least one cellulosic binder selected from the group consisting of carboxymethyl cellulose, methyl cellulose, hydroxyethyl cellulose, hydroxypropyl cellulose, [and] hydroxypropyl methyl cellulose [or] and natural polymer.

12. (Unamended) The composition of Claim 1, wherein the additive comprises at least one material selected from the group consisting of polyacrylic acid, sodium polyacrylate, polyacrylamide, and two or three copolymerized compounds thereof.

13. (Amended) The composition of Claim 1, wherein the additive [is] comprises a silane compound.

14. (Amended) The composition of Claim 1, [wherein the fuel consists] consisting of 5-aminotetrazole and guanidine nitrate, [the oxidizing agent consists of] strontium nitrate, and [the additive consists of] silicon nitride and synthetic hydrotalcite.

15. (Amended) The composition of Claim 1, [wherein the fuel consists] consisting of 5-aminotetrazole and guanidine nitrate, [the oxidizing agent consists of] strontium nitrate and potassium nitrate, and [the additive consists of] silicon nitride and synthetic hydrotalcite.

16. (Amended) The composition of Claim 1, [wherein the fuel consists] consisting of 5-aminotetrazole and guanidine nitrate, [the oxidizing agent consists of] strontium nitrate and basic copper nitrate, and [the additive consists of] silicon nitride and synthetic hydrotalcite.

Claims 17-19. (Cancelled)

20. (Amended) The composition of Claim 1, [wherein the fuel consist] consisting of 5-aminotetrazole and guanidine nitrate, [the oxidizing agent consists of] strontium nitrate and ammonium perchlorate, and [the additive consists of] polyacrylamide and a silane compound.

21. (Amended) The composition of Claim 1, which comprises
10-30 weight% of 5-aminotetrazole [as the high-energy nitrogen-containing organic compound],
5-30 weight% of guanidine nitrate [as the low-energy nitrogen-containing organic compound],
30-70 weight% of strontium nitrate [as the oxidizing agent], and
0.5-10 weight% of silicon nitride and 2-10 weight% of synthetic hydrotalcite [as the additive].

Claims 22-23. (Cancelled)

24. (Amended) The composition of Claim 1, which comprises
10-30 weight% of 5-aminotetrazole [as the high-energy nitrogen-containing organic compound],
5-30 weight% of guanidine nitrate [as the low-energy nitrogen-containing organic compound],
10-50 weight% of strontium nitrate and
10-50 weight% of ammonium perchlorate [as the oxidizing agent], and

0.5-10 weight% of polyacrylamide and 0.5-10 weight% of silane compound [as the additive].

25. (Amended) The composition of [Claims 21 or 24] Claim 1, which further comprises not more than 10 weight% of potassium nitrate.

26. (Amended) The composition of [Claims 21 or 24] Claim 1, which further comprises not more than 30 weight% of basic copper nitrate.

27. (Cancelled)

Add new Claims 28-42:

--25.-42. (New)--